

SOIL SURVEY OF ARCHER COUNTY, TEXAS.

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DESCRIPTION OF THE AREA.

Archer County is in the north-central part of Texas. It is bordered on the north by Wichita County, on the east by Clay and Jack Counties, on the south by Young, and on the west by Baylor County. It has an area of 886 square miles, or 567,040 acres.

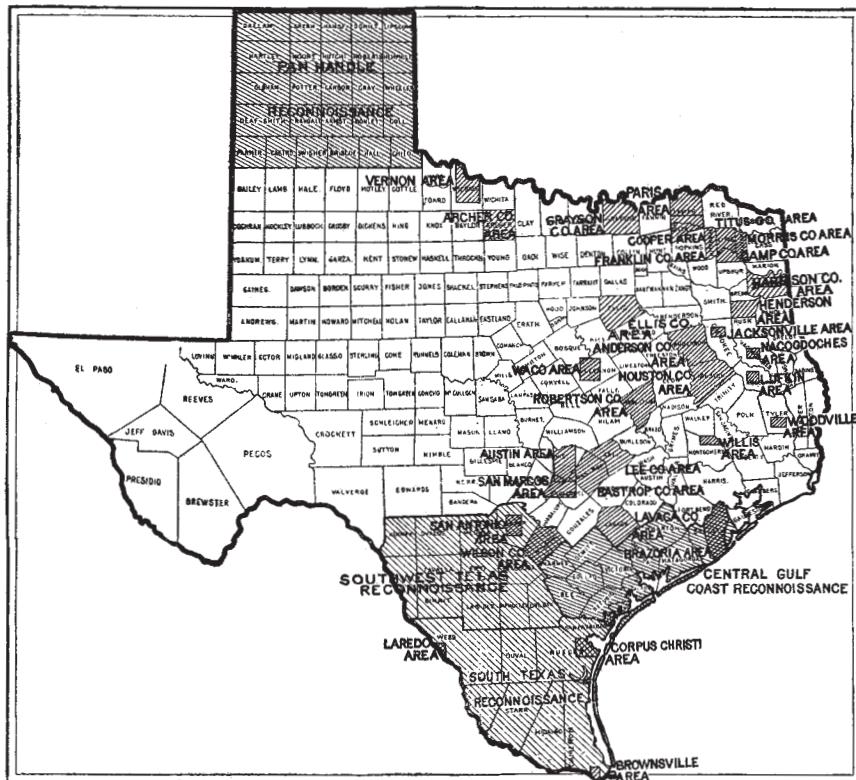


FIG. 24.—Sketch map showing areas surveyed in Texas.

Archer City, the county seat, with a population of 825, and Megargel, with a somewhat smaller population, are the most important towns in the county. Both have cotton gins and lumber yards, and are important shipping points. The first permanent settle-

ments in the county were made at Archer City in 1875, and at Windthorst in 1888. The county was organized in 1881.

Archer County is sparsely settled, although the population is rapidly increasing. According to the census of 1910, the population of the county was 6,525, an increase of 4,017 over that reported for 1900. The inhabitants for the most part are American born, although there are two German settlements, one in the vicinity of Windthorst and the other in the south-central part of the county.

The Wichita Valley Railway, which was built in 1890, extends across the northwestern corner of the county. In 1908 the Wichita Falls & Southern Railway was built through the central part of the county in a north and south direction, and one year later the Southwestern Railway opened a line between Archer City and Henrietta, crossing the northeastern section. The same year the Gulf, Texas & Western Railway began operating trains across the southwestern corner of the county, through Megargel.

With the advent of the railroads some attention was given to road building. The main public highways, however, were until recently obstructed by gates. The main roads are graded and the streams are bridged, but no surfacing material has been applied. Large quantities of calcareous conglomerate and limestone are available in the county for use as road-building material.

Physiographically, Archer County is located in the central prairie plains region of Texas. This region lies between the High Plains, or Llano Estacado, on the west and the Gulf Coastal Plain on the east. The prairie plains represent an old land surface which was reduced by erosion in post-Permian age to a comparatively level surface or peneplain. Later it was re-elevated, and has subsequently been incised by stream erosion. Remnants of the former generally level surface are found on the stream divides. Archer County comprises a level to undulating and moderately broken plain, with a general slope to the northwest. The average elevation of the county, according to determinations made by railroad and other surveys, is 1,115 feet. The elevation at the church mound of Windthorst is 1,675 feet, at Archer City 1,041 feet, at Anarene 1,128 feet, Luke Wilson 1,071 feet, Scotland 991 feet, Holliday 943 feet, Dundee 914 feet, and Megargel 1,286 feet.

The drainage of the county is through three main courses which have a general eastward direction, the Wichita River and its immediate tributaries draining the northwest part of the county, the Little Wichita system draining the southwest, northeast, and part of the southeast sections, and the West Fork of Trinity River the southeast corner. Lying approximately parallel to these principal stream courses are a number of ridges with long gentle slopes to the northwest and short and often precipitous slopes to the southeast.

This topography has been brought about by the erosion of alternating beds of resistant sandstone and nonresistant clays, which dip toward the northwest. A typical example of this topographic development is seen at the southern limit of the long slope, or gently undulating plain, extending northwestward to the South Fork of Little Wichita River, and occupied by Archer City. The town of Scotland is situated on this same plain, the Little Wichita River constituting its northern boundary and the steep escarpment formed by the massive sandstone outcropping south of the town, its southern border. This escarpment can be followed westward south of Archer City, past Sturgeon School, and on southwestward to Megargel. Other similar ridges, almost parallel to the one described, occur between Wichita River and Hollidays Creek, between Hollidays Creek and the North Fork of Little Wichita River, north of Lake Creek, between Lake Creek and the Little Wichita River, and in the high plateau in which Onion Creek and the tributaries of the West Fork of Trinity River head. There are some five main northeast and southwest ridges and a number of smaller ones. Not all of these, however, continue entirely across the county, since they merge toward the west, so that along the south and west boundaries there are only four of the ridges. The long, gentle northwest slopes are so smooth that they are almost imperceptible and have more the appearance of gently undulating plains.

A number of flat-topped mesas and mounds, some of which are three-fourths of a mile in length and one-tenth to one-fifth of a mile wide, are prominent in the highly eroded regions. These are remnants of erosion, due to the more indurated and nearly horizontal formations which cap the mesas having resisted stream and wind work, while the adjacent beds yielded.

CLIMATE.

The most reliable climatic statistics are from the records of the Weather Bureau station at Graham, Young County, a few miles south of Archer County. These indicate that the climate of the region is marked by extreme temperatures. The highest and lowest recorded during a period of 10 years are 110° F. and —5° F., giving a maximum range of 115°. The mean summer temperature is 82.2° and the mean winter temperature 45.1° F. During the summer months the strong, hot winds from the south often destroy, or at least seriously injure, crops of corn, wheat, oats, and cotton, while raw, cold winds from the north frequently result in the loss of cattle during the late fall and winter months. When the hot winds are of long duration and the land is not well mulched, the evaporation of the moisture from the soil is very rapid, leaving a supply inadequate

to carry the crop through the season. The small grains and often the corn are matured before the advent of these winds, which are generally worst during the latter part of July.

According to the precipitation records of the Weather Bureau station at Graham, covering the period 1852 to 1909, the maximum precipitation occurs in May and the minimum in January. The summer has the highest seasonal mean precipitation and the winter the lowest. This indicates the desirability of plowing and pulverizing the soil in August, so that an adequate amount of moisture may be stored for use during the following year. No uniformity of distribution can be depended upon either for any month or season. For example, a very low precipitation during the growing season occurred in Archer County for three consecutive years, resulting in general crop failures in 1909, 1910, and 1911. In these years severe summer droughts were accompanied by hot winds. When compared with the eastern United States the mean annual rainfall is not only much lower, but with the irregularities in seasonal distribution and the rapid evaporation due to high winds and intense sunshine, agriculture is far more uncertain. As a consequence very different methods of cultivation and the combination of stock raising with farming must be practiced in order to succeed.

Winds are prevailingly from the south. In the spring winds of high velocity are almost constant, and although not so constant during the summer months, they are hot and dry, causing a high rate of evaporation of moisture from the soil. The fall and winter winds are not so injurious to crops, yet they, too, draw much moisture from the ground. It is only by maintaining a surface mulch that this evaporation can be reduced to a point where successful cropping is possible.

Severe hailstorms are not uncommon, but are local, seldom affecting more than 2 or 3 square miles. They often result in the destruction of growing crops.

The average date of the first killing frost of fall is November 10 and the earliest date recorded is October 28. The average date of last killing frost of spring is April 2, the latest recorded being April 17. This gives a long growing season, so that two crops are not uncommonly grown on a field during a single season.

The following table shows the mean monthly, seasonal, and annual temperature and precipitation as recorded at the Weather Bureau station at Graham, Young County:

Normal monthly, seasonal, and annual temperature and precipitation at Graham, Young County, Tex.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
December.....	*F. 46.6	*F. 85	*F. 2	Inches. 1.37	Inches. 0.17	Inches. 0.40	Inches. 1.0
January.....	43.2	89	-5	0.81	1.00	2.16	1.7
February.....	45.4	99	-5	1.16	0.48	3.27	2.6
Winter.....	45.1	.....	.....	3.34	1.65	5.83	5.3
March.....	57.7	103	12	1.55	0.04	1.13	0.0
April.....	65.2	102	30	2.45	0.63	0.37	0.0
May.....	73.0	108	38	4.22	3.36	2.76	0.0
Spring.....	65.3	.....	.....	8.22	4.03	4.26	0.0
June.....	79.8	110	48	3.99	3.94	1.87	0.0
July.....	83.2	110	52	2.81	0.55	9.56	0.0
August.....	83.5	110	47	2.69	2.83	8.65	0.0
Summer.....	82.2	.....	.....	9.49	7.32	20.08	0.0
September.....	78.3	109	37	2.78	1.87	9.33	0.0
October.....	64.0	101	28	2.47	1.61	1.55	0.0
November.....	53.3	93	3	2.11	T.	2.56	0.1
Fall.....	65.2	.....	.....	7.36	3.48	13.44	0.1
Year.....	64.4	110	-5	28.41	16.48	43.61	5.4

AGRICULTURE.

Archer County was formerly a part of a great open range which embraced many thousands of square miles. Aside from a small acreage of wheat which is reported to have been grown as early as 1874, agriculture was not practiced until 1880. The early farmers, termed "nesters" by the ranchmen, met with serious obstacles in their attempts to establish agriculture. They were opposed by the ranchers, who anticipated the conversion of the open range into farms attended by fence building, road construction, and higher taxation. In addition to repeated crop failures occasioned by droughts, severe losses through the ravages of rabbits, prairie dogs, and wolves were sustained. The tools employed were unsuited to the proper breaking and cultivation of the soil, and Fort Worth was the nearest railroad station or trading point of any consequence, yet the development of agriculture continued despite these disadvantages, and it has been demonstrated that farming may be profitably conducted.

While wheat growing for many years was the leading industry, a gradual decrease in yields on account of the successive cropping of the same fields has encouraged the practice of a more diversified farming. For the last eight years cotton has superseded wheat as the leading crop, and the production of oats, kafir, and milo is rapidly increasing.

The present agriculture consists of ranching, general farming, and farming in connection with dairying. About 90 per cent of the land is devoted to ranching, 8 per cent to farming without dairying, and 2 per cent to farming with dairying. Although several large ranches are devoted almost exclusively to raising beef cattle, in most cases the ranchers practice general farming in connection with cattle raising. A few have combined farming and sheep raising, while a larger number raise horses and mules.

Formerly, when the open range existed, and when land had a low value and good grazing was plentiful, cattle raising was a profitable industry, but with the advance in the price of land, the necessity of fencing, and with closely grazed pastures, it has become of more uncertain profit. During an open winter some green grasses are available and the herds thrive, but with severe weather and insufficient pasturage, such as prevailed during the winter of 1912, a large part of the cattle perish unless feed can be procured. As a rule feed can only be obtained at a high price and must be hauled over difficult roads and trails for long distances. Owing to these conditions the ranchers are growing more forage crops than formerly for home use.

This method of supplementing ranching with a little special farming is proving successful. Where well supplied with roughage the stock can easily survive the winters. The surest of these roughage crops are Johnson grass, kafir, and sorghum, but rye, oats, and millet are also used. Any of these crops except Johnson grass can be sowed as late as August, but they do better if started in July or earlier. Some of the best soil types for the production of feed can be found on practically all of the ranches.

On a holding of a thousand acres or less the practice of general farming and ranching constitutes a most profitable combination. The owner can devote his best farming land to crops, depending on his individual requirements to determine the kind of crops and the amount of land to cultivate.

The crop failures during 1909, 1910, and 1911, caused by prolonged droughts and hot winds, resulted in severe losses to the farmers who depended on crop production exclusively. The experience, however, taught the farmers that there is ordinarily very little moisture in the ground at planting time and that they are dependent, to a certain

extent, upon the rainfall of the growing season. This having proved so uncertain, the acreage devoted to cotton, corn, and spring oats was reduced and more attention given to the drought resistant crops, such as kafir, milo, Johnson grass, and sorghum, the kafir and milo yielding grain for work horses and the kafir, Johnson grass, and sorghum furnishing roughage for the cattle. In the event of failure of corn, oats, and wheat, with the advance of the season, there is still sufficient time to sow and harvest a crop of sorghum, millet, or kafir for roughage. During years of abundant rainfall and when the ground is well supplied with moisture in the spring the farmer can, with careful cultivation, conserve sufficient moisture to carry him over droughts of ordinary duration. The area devoted to cotton and corn is accordingly increased with the reasonable expectation of much better returns than could possibly be hoped for if less of these crops and more roughage crops for cattle were grown.

To depend on crops solely, like farmers of eastern United States, without any stock other than a milch cow and a few pigs for home use, is the least profitable form of agriculture in the county, regardless of the size of the farm. Such farming may pay well in favorable years, but in connection with the raising of stock, whether beef or dairy cattle, sheep, hogs, horses, or mules, much better results may be obtained.

A combination of dairying with crop growing has given excellent returns within a radius of 5 or 6 miles of Windthorst. Here the average farmer has from 10 to 15 milch cows, and a few dairymen as high as 30 or 35. The cream is obtained at home by means of centrifugal separators and sent to a farmers' cooperative creamery at Windthorst, where it is made into butter which is shipped to Chicago. The skimmed milk is fed to calves and hogs. Although a majority of the cows of the typical herd are probably more of the beef type than the dairy, being largely Shorthorns, excellent profits are realized. Crops are so planned, according to seasonable conditions, that sufficient feed can be grown for the dairy. Silos have not been erected, but their use would eliminate the decrease in milk flow which is occasioned by lean pastures and inferior feeds. Johnson grass, kafir, and alfalfa, all of which can be grown successfully in the county, may be used for ensilage. Johnson grass can be grown for this purpose in the most droughty years, thus insuring an excellent feed at all times.

The raising of beef cattle is the leading industry of the county, but is rapidly giving place to general farming and dairying. The cattle are mainly of the Durham or Shorthorn breeds, while the Hereford is second and the Galloway and Angus third in importance. Under normal conditions 10 acres will furnish ample feed to fatten

one steer. The grazing on the heavier soils, which are more difficult to till and cultivate, is generally better than on the lighter. The heavier types are widely developed in the rougher sections of Archer County and are well supplied with streams which contain pools where the cattle can find water during the most severe droughts. Groves of mesquite trees afford protection from storms. While the surface features are not a hindrance to the raising of beef cattle they tend to discourage farming, so that it is quite reasonable to assume that the stock business will continue as a very important industry in the region. The fattened steers are shipped mainly to Fort Worth.

Cotton is the leading crop both in acreage and cash returns. The cotton fields are usually broken to a depth of 4 or 5 inches and prepared during the winter months with the double-moldboard plow or "middle buster," but a higher moisture content and a better seed bed may be had if the ground is broken in August to a depth of 10 or 12 inches by double or triple listing or disking, followed by thorough pulverizing and later a shallow harrowing after rains to maintain a mulch. Planting is usually done about the middle of April but may range from April 1 to June 1. The best seed is procured by the careful selection of seed in the field. The lister planter is used, the ridges left by the lister or "middle buster" being divided and an almost level surface or one but slightly ridged produced. This somewhat roughened surface is desirable on the more sandy land, as it tends to prevent drifting, to which these soils are especially subject during the spring months. After thinning, the "go-devil" plow is used in cultivation, as it works closer to the plants than the wheel cultivator. The better farmers cultivate cotton biweekly until the cotton sets bolls, which is in August. Cotton picking begins in late September and sometimes continues until January. Yields vary from one-fifteenth to 1 bale per acre, depending on rainfall and the severity of the hot winds, the average crop being about two-fifths bale per acre. Gins are located at Megargel, Coston, Archer City, Windthorst, Scotland, Holliday, Mankins, and Dundee.

The preparation of the soil for corn is practically the same as that for cotton. Even more care should be exercised in preserving moisture, as corn is not so drought-resistant as cotton. Ten inches of water is required for a crop of corn in this region. Except during a late spring, corn is planted about the middle of March, and sometimes as early as March 1. To avoid the hot winds of midsummer, which, if severe, are almost certain to destroy the setting of grain, the seed should be planted as early as possible and only very early varieties should be used, so that the crop may mature between July 10 and August 1. The yellow dent varieties are most common, as they are early and yield well, while the white varieties are not so

popular, being later and more subject to smut. The Bloody Butcher variety is popular in the county. Without a good supply of moisture in the ground at the time of planting it is not advisable to grow corn, because of danger of drought. The more sandy soils seem best adapted to both cotton and corn, probably for the reason that they mulch more perfectly. These crops are grown mainly about Megargel, around Black Flat School, throughout the broom-sedge area in the eastern part of the county, and in the old bottom bordering the Hollidays and Panther Creek bottoms. The darker colored soils, rich in humus and having a natural mulch, produce the largest crops. The range in yields is from practically nothing to 60 bushels per acre.

In the production of wheat, barley, rye, oats, and speltz early deep plowing, thorough pulverization, and moisture conservation are essential. All of these grains are commonly sown in the fall. Some wheat is sown in the spring, but the yield is less than that of the fall wheat and the crop suffers more from smut. Fall oats mature about June 1, while spring oats mature between June 15 and July 1. The speltz yields range between those of wheat and oats, averaging from 25 to 35 bushels per acre. Speltz stands dry weather better than either of the other grains, and never smuts. Barley has produced as high as 30 bushels to the acre, but very little is grown, since it is said to smut badly and does not grow high enough for cutting with the binder. Fair crops of rye have been obtained, but only a very small acreage has been grown.

Much carelessness is evident in the manner of preparing the land for these crops. The breaking is often very shallow. The wheat and speltz are drilled in, but the oats are frequently sowed broadcast and then harrowed in without further preparation. Oats are sometimes sowed on cotton ground in January, and after the plants are up the cotton stalks are removed with stalk choppers. With such methods the yields, except in very favorable years, are low. On a carefully prepared field adjoining a poorly prepared field of similar soil the yield of the first was 13 bushels of wheat, while that of the second was $3\frac{1}{2}$ bushels per acre.

The custom of growing wheat year after year on the same field has resulted in a steady decline in yields. A rotation of crops, to include some legume such as cowpeas, sweet clover, or alfalfa, will be of great benefit in reestablishing such soil, and especially is this true if the green legume be plowed into the soil. When these crops are sown in the fall, during the succeeding spring a spike harrow should be dragged through them after a rain and while the plants are very small.

Although milo and kafir are unquestionably more drought-resistant than cotton and corn, the same careful methods in preparing the land are employed by the better farmers. These grains are better

adapted to semiarid conditions than the usual staples and should be grown much more extensively in the county. Excellent yields are produced, while the nutritive qualities are almost equal to those of corn.

Milo has its chief value in early maturing, as a crop can be secured in 60 days. It may be planted early in the spring or as late as August, after wheat, oats, rye, and speltz have been harvested. Of course when milo follows these other crops, which exhaust the soil moisture, only a small yield may be expected, unless the rainfall is plentiful. It is usually planted in rows $3\frac{1}{2}$ feet apart, and the spaces between stalks are from 4 to 6 inches. The red variety is reputed to give better yields than the white. Yields range from 10 to 60 bushels, depending upon the preparation and condition of the land and the season. The stalk is woody and unpalatable for stock, but after a crop is harvested a second growth makes good feed.

Kafir has about the same planting period, and is sowed and cared for in the same way as milo maize. Crop yields are also comparable, but kafir is superior to milo in that its stover makes good forage and it is well suited for ensilage. In most cases the best crops of kafir and milo have been grown on the sandy soils, but the reason largely lies in the fact that with extensive farming the natural mulching and mellow character of these lighter lands render them particularly suitable for seed beds and able to withstand droughts, while on the heavier soils it is necessary to develop these requisites by intensive cultivation.

Of the hay crops, probably Johnson grass is the most important, owing to its ability to withstand drought and its large yields. With only moderate care in preparation of the land and in seeding, a crop is assured even during the most droughty years. The seed is sown in February and the first cutting is taken off in July. With rain, a second crop can be cut in the fall. During the second year, when the roots have become well established, the yields are heavier and surer, and sometimes as many as three cuttings are obtained. The total yield ranges from 5 to 6 tons annually to the acre. The market price of Johnson grass hay is from \$10 to \$12 a ton. Sorghum is not as drought resistant as Johnson grass, yet rarely fails to yield profitable crops with proper care. It is nutritive and is relished by stock. In an average year yields of 5 to 6 tons per acre are secured. One or possibly two cuttings can be made during a season.

Millet, which has an extended planting period, from early spring to August, grows wild to a height of 2 feet, and yields heavily when sowed on prepared lands. It makes a good hay and is giving excellent satisfaction where used. Oats and rye are sometimes cut for hay.

Alfalfa promises to become an important hay crop, but at present it has little more than entered the experimental stage. Only small

patches of one-half acre to 5 acres have been tried, but these have demonstrated conclusively that the crop can be grown successfully on the sandy soils. On a sandy phase of the Vernon fine sandy loam, a mile east of Archer City, the soil was broken to a depth of 7 inches, a good seed bed prepared and inoculated in the spring of the extremely dry season of 1911. Alfalfa was sowed broadcast and the ground subsequently harrowed, covering the seed to a depth of 1½ inches. Even with the succeeding drought a stand was obtained, and bacteria nodules developed on the roots. The alfalfa was cut the latter part of April, 1912, and gave an excellent yield. This crop is also being successfully grown on the Miller very fine sandy loam. The chief requisites for growing alfalfa seem to be a loose, mellow, and highly fertile seed bed, thoroughly prepared and free from weeds, careful inoculation of the land with a culture, or by simply scattering over the surface the soil procured from alfalfa or sweet-clover land, and good seed. The production of alfalfa, which is the most nutritious of all hays, would solve the problem of securing proper feed for dairy cattle and hogs.

Sweet clover constitutes another promising leguminous crop which is only in its experimental stage. The successful production of this crop is reported north of Iowa Park in Wichita County. If cut before it becomes stemmy sweet clover makes a good hay. It is almost the equal of alfalfa as a soil improver.

Cowpeas are sometimes sowed between corn rows at the last cultivation. In this way considerable forage and grain are obtained, but better returns may be had by growing the cowpeas alone. In some sections of the South this legume is the most important plant for reestablishing the productiveness of "worn-out" fields. It is also a valuable feed for dairy cattle. Its production should receive greater attention in Archer County.

Practically every farmer has a vegetable garden, but the supply is frequently insufficient even for home needs, so that grocers of the small towns buy much of their garden truck from outside sources, notwithstanding the fact that the light flood-plain and terrace soils are especially adapted to trucking. Such sites as those indicated in the description of the Bastrop and Miller series in the following pages are admirably situated for irrigation, which would make crops almost a certainty. Many farms include small creek bottoms, where the soil is loose, mellow, and rich in organic matter. A small dam would hold sufficient water to irrigate a garden spot on such bottoms, which could be used to produce vegetables for nine months of the year. Such small irrigating systems, while inexpensive, would not only supply the immediate needs of the home but give some surplus for sale, which, at the ruling high prices, would add materially to the income of the farms. In a number of cases a dam has already

been installed for watering cattle, the only further requisite being the construction of irrigating ditches, which could be accomplished without difficulty. On a few farms, where such a stream is not available, elevated wooden tanks are filled with water from the wells and used successfully to water small gardens.

On the irrigated areas of the Bastrop very fine sandy loam between Lake Wichita and Wichita Falls, truck crops of all descriptions were grown successfully during the extremely droughty season of 1911. Among the products were Bermuda onions, which gave a yield of 400 bushels to the acre, beets, of which as much as 2 tons per acre were obtained, and turnips, yielding 400 bushels per acre. On one-half acre of land, strawberries were grown which sold for \$310. Excellent yields of lettuce, tomatoes, okra, carrots, and cabbage were obtained. Melons of excellent texture and flavor have been produced successfully on the sandy areas of Archer County. If markets were available the melon industry might become very profitable. Grapes are being grown in the vicinity of Windthorst on the broom-sedge phases of the Vernon fine sandy loam. With careful cultivation and pruning the vines make a thrifty growth and bear well. The grapes are used for the most part in making wine and preserves for home consumption.

Some tree fruits are to be found on most of the farms and ranches, though little fruit is produced except for home consumption, and none of the fruits without careful attention to cultivation and pruning. The peach is the most important fruit. It seems to do best on the sandy soils. The Elberta is the leading variety, ripening the latter part of June. Where the bedrock lies near the surface, the trees suffer from drought and are not thrifty. Plums also do well on the sandy soils, the Burbank varieties being considered the most productive. Cherries yield fairly well, but apples, pears, and apricots are not successfully grown. Mulberry trees grow wild along the streams and seem to produce an abundance of fruit.

With careful cultivation berries can be profitably grown, the dewberry producing best, with the blackberry a close second. Strawberries can not be grown successfully without irrigation.

The forest trees in the county, with the exception of the mesquite and a few varieties found along streams, are confined to a belt crossing the southeast corner of the county, in which a generally scrubby growth of post oak is found. The trees though small are used for fuel and fence posts. A few settlers have used the larger trunks in erecting log cabins. Mingled with these post oaks are occasional blackjack oaks and mesquites. Mesquite is found more or less throughout the upland section of the county, but only scatteringly in the broom-sedge district. Its general distribution has resulted from the use of the land by cattle, which eat the mesquite pods and scatter the seeds.

About the only use of this wood is for fence posts and fuel. Cattle and goats browse on the twigs, leaves, and pods. Owing to the loss of pasture because of the space occupied, the moisture required, and the shading of the grass by the trees, the mesquite is a menace to the grazing land and its spread should, in some way, be prevented.

Where moisture is available on narrow benches along the principal streams cottonwood, elm, ash, live oak, pecan, hackberry, Chinaberry, mulberry, Chickasaw plum, dogwood, willow, sumac, and some other trees may be found. Like the mesquite and post oak, the principal use of these trees is for fuel and fence posts.

When free open range formed most of Archer County grama grass and broom sedge were about as abundant as the curly mesquite; but after being subjected to close grazing, with their less resistance to drought they could not endure on the dry, heavy soils and were displaced by the hardier mesquite. The grama grass is now found mainly in the sandy bottoms, where it makes a rank growth and supplies excellent pasturage. The broom sedge is confined to the loose, sandy prairie land, mainly in the eastern part of the county. The growth of the grama grass and broom sedge is largely dependent upon the natural mulch which is formed over the sandy prairies and loose bottoms, rendering them capable of absorbing and retaining comparatively large quantities of moisture, but the curly mesquite has gradually extended its limits into the prairies and bottom lands, where it is displacing the other grasses. The early grasses, such as wild rye, running mesquite, and needle grass, are well distributed over the area. They afford little other than winter and early spring pasturage, but grow at a time when the principal grazing grasses are just coming up and consequently occupy a very important place as feed for the stock. With the exception of sowing a few fields in Johnson grass, very little effort has been made to renovate the pastures or to introduce grasses. Such practices, however, will undoubtedly play an important part in developing pastures in the future. It is very probable that Bermuda grass, which has been grown successfully in lawns, could be used to good advantage in improving the pastures.

No general scheme of crop rotation is followed. Many successive crops of cotton or wheat are sometimes grown in the same fields, resulting in a decline in the yields and the exhaustion of the soil. In some cases cotton is followed with oats, but seeding to grass is rare. To get the best results, a systematic rotation of crops should be followed, and such rotation should include a leguminous crop. On sandy soils cowpeas, sweet clover, alfalfa, and possibly vetch or soy beans may be used advantageously; but for the heavier soils experiments will be necessary to determine which legumes can be best

used. All of the soils, except possibly some types of the Greensburg and Kirkland series, are in need of humus, which in the absence of stable manure can be supplied most economically by turning under green leguminous crops. The incorporation of organic matter will improve the water-holding capacity of the soil and promote a better physical condition generally. Cowpeas or sweet clover, which may be grown with less difficulty than alfalfa, or the other clovers will probably be the most suitable crops for soil improvement.

Another means of increasing the profits in agriculture in Archer County is to devote more care to breeding stock. There are a few pure-bred English Shire, Percheron, and Clydesdale stallions now in the county, but the mares are small and hardly of medium grade. Pure-bred breeding mares of the draft type should be introduced.

In raising mules even less care is exercised in breeding than in the case of horses. This industry offers another good opportunity, especially with the present demand, and should receive more attention. At weaning time a mule colt brings \$50, and if of fair size and not wild will command \$200 at 2 years of age.

With an extension of the alfalfa acreage and of dairying, hog raising should become profitable. At present, hogs are raised only for home consumption. There are more of the Poland China breed than any other, though a few Berkshire and Duroc-Jerseys were seen. Hog cholera has so far not visited this section.

In some sections the raising of Angora goats is a profitable industry. Where brush and trees are available for browsing, wool and meat of goats may be produced very cheaply. Sheep raising is confined to the northwestern corner of the county. The principal breeds are the Lincoln, Rambouillet, and Shropshire. It is claimed by those interested in sheep raising that this industry is fully as profitable as raising cattle, provided woven-wire fences are maintained to protect the herds from coyotes.

The number of pure-bred dairy cattle, principally Jerseys and Holsteins, is small, the great majority of the milch cows being grades of these bloods or of some of the beef breeds. The quality of the milk could be materially improved by the exercise of a little care in breeding. The feeding and housing of the dairy herds should also receive greater attention, in order to increase their efficiency.

For general farm purposes labor is scarce, and it is especially difficult to secure the services of experienced men. Cotton picking and the harvesting of other crops are often greatly delayed for want of help. When men are employed by the month they usually receive from \$15 to \$25, their board and washing included, while day laborers receive from \$1.50 to \$2.50, depending on season and form of employment. Cowboys on the ranches receive from \$25 to \$40 a month and board.

About half of the farms in Archer County are operated by the owners. Practically all of the tenants operate on a share basis. Throughout the older sections of the county the farmers have large two-story houses, which are kept in excellent repair. Fair barns are provided for the milch cows, work stock, and the storage of feed. Most of the houses, however, consist of smaller cottages of 3 to 6 rooms. These are well kept. As a rule farms thus improved have little more than a shed for accomodation of the stock. The absence of large, capacious barns, such as are seen on farms in the Northern States, is due to the high price of lumber and to the usual mild winters. There is great need of improvement in the construction of barns, in order to protect the stock from the severe "northerns," which result in the actual loss of cattle as well as marked decrease in milk flow.

ALKALI CONDITIONS.

"Alkali spots" appear to some extent in almost all of the types. Some of these cover several acres. The texture of the material is always relatively heavier than that of the soils in which they occur, often being that of a clay at the surface, where the adjacent soil is a fine sandy loam, or, in other places, a clayey, sticky loam or clay loam. In all cases, the soil in these spots runs together after rains and becomes much more compact than adjacent soils, the surface crusting and generally assuming a lighter color. These spots in the fields after rains are readily discernible in driving along the roads. They ordinarily occur in slight depressions. Closer examination shows that frequently the spots have very similar qualities to those of the subsoil, being very heavy, compact, intractable, calcareous, and unoxidized. Some of them may be merely the outcropping of the subsoil at the surface, as the subsoil does not lie at a uniform depth. On the other hand, the soil in many of these spots has a salty or bitter taste and efflorescences appear on the surface. Chemical analyses of samples from such places show the presence of sufficient alkali to be detrimental to plant growth.

On the spots where alkali can not be detected by taste or efflorescence, as well as where it can, crops are reported to be unable to endure dry weather, but in wet years crops frequently do as well in these depressions as elsewhere. This indicates that either the moisture is one of the great needs, the material being too impervious to admit more than small quantities for the use of the plants, or the alkali salts are leached down in solution to lower depths, where they do not affect plant growth.

Probably none of these spots are beyond reclamation. Where the difficulty seems to be due to the heavy, impervious structure and not so much to the alkali, remedies have already been found.

The prairie dogs and red ants have improved some places by carrying up the gravel, sand, and coarse material from beneath, which through subsequent plowing, have become thoroughly mixed with the soil, loosening and breaking up the compact and cemented material and thus admitting air, heat, and moisture, so that chemical and bacterial action may become normal. Some farmers have worked barnyard manure or straw thoroughly into the soil to a depth of 12 inches with similar results. By following this practice, with careful pulverization and continuing the treatments successively from year to year they have brought the alkali spots into a fair state of productiveness. Another method which has proved successful in reclaiming land from which the soil has been washed, leaving the subsoil exposed at the surface, and which would undoubtedly prove effective on these alkaline spots, is the growing of cowpeas or some other legume, or, if legumes will not grow, rye, oats, millet, or Johnson grass, and incorporating the crop deeply into these areas as a green manure.

Chemical analyses show the predominating salts in one of the typical alkali spots to be sodium chloride and sodium sulphate, both of which are readily soluble and easily leached from the soil. These salts are much less dangerous than the sodium carbonate. Of the two, the sodium chloride is the more injurious.

SOILS.

The rock formations, from which the soils of Archer County have been derived, consist of sandstones, shales, clays, conglomerates, and occasional limestones. The strata all dip uniformly to the northwest, which arrangement exposes the oldest rocks in the southeastern corner of the county and the youngest in the northwestern corner. The oldest rocks, which occupy a small area, are said to belong to the Carboniferous period. These consist of sandstones, shales, and clays, but the sandstones are more massive, thicker, and coarser grained than are most of those lying higher in the geological column. The remainder of the rocks, with the exception of the gravelly conglomerate of Black Flat and vicinity, which lies unconformably on the older Permian rocks and of which the age is uncertain, belong to the Red Beds group of the Permian period.

The Permian rocks consist of sandstones, shales, and clays, the clays being largely deep red or chocolate red in color, the sandstones characteristically grayish to yellowish gray, and the shale usually yellowish gray and occasionally bluish gray. Since the greater part of this section consists of clays, these give the prevailing red color to the landscape and to the soils. They also have the predominating influence in the formation of the soils, so that as a rule the subsoils particularly are heavy.

The sandstones of the Permian are, as a rule, more thin bedded than are those of the Carboniferous; they are finer in grain and seem to be more calcareous. The clays of the Permian beds are likewise calcareous, the calcium carbonate usually occurring as nodules in the outcrops, these often being very abundant on the clay slopes. Toward the southwest the sandstones seem to become progressively more calcareous. The beds which in the northeastern corner of the county appear to carry a very small proportion of lime, in the southwestern corner are heavily impregnated with it. In many cases they are more like sandy limestones than calcareous sandstones. The gravelly conglomerate underlying Black Flat and appearing at many places in the northwestern corner of the county is very calcareous. As it approaches the Wichita River it contains a larger amount of water-worn quartz pebbles. Here it appears in exposures 10 to 12 feet thick and lies at an elevation of approximately 100 feet above the river. In the same vicinity thin beds of limestone occur and others are found south and east of Lake Wichita.

A more detailed examination of the clay and shale formations shows them to be massively bedded to poorly stratified. They are soft and easily eroded and, in places, contain an abundance of calcareous nodules of irregular shape, varying from the size of a pea to pieces 4 or 5 inches in diameter. These nodules may be of a drab, brown, or red color. Occasionally crystalline calcite, celestite, and pyrite are seen. Rough, angular fragments of calcareous clay, generally having a dark-red color due to iron oxide, are common. A few of these fragments are green, owing to the malachite or copper carbonate stain. At the sandstone contacts rounded quartz pebbles may be seen.

The sandstone generally occurs in thin, nonpersistent layers, interbedded with clay. The rock is predominantly soft and friable, but a few dark-colored isolated quartzite layers are found. It is generally more or less crossbedded. Clay is the main impurity, the sandstone almost always grading into clay wherever it thins out. Calcareous, disk-shaped nodules from an inch to $2\frac{1}{2}$ inches in diameter are found in places in the sandstone. Along joint and bedding planes malachite and azurite sometimes occur, producing a green stain in the sandstone with which they are in contact.

The limestone is characteristically very thin bedded, and is either argillaceous or arenaceous, depending on whether it is in contact with clay or sandstone. The color varies from drab to bluish gray, which takes on a peculiar bronze coating when weathered. Thin, flaggy limestone, 3 to 4 feet in thickness, caps a high plateau northwest of Dundee and gives rise to the Kirkland clay and clay loam.

A conspicuous conglomerate underlies the Black Flat and extends westward and northward to the county lines, appearing in the upper parts of the bluffs of the Wichita River. The components of the conglomerate seem to be mainly of local origin and consist of calcareous, nodular fragments of sandstone, these being both rounded and angular, while waterworn pebbles of quartz, flint, and jasper are rather abundant in the exposures along Wichita River. A high percentage of clay and sand helps to make up this conglomerate, and calcium carbonate and iron oxide are the cementing agents. Natural exposures do not reveal a thickness of over 12 feet. The formation varies from a very hard and firmly cemented to rather friable rock, which can be crushed in the hand or easily broken with a hammer.

All of the upland soils of Archer County, with the exception of a few bands of colluvial material which occur along the bases of slopes and are too small to map, are residual in origin, having been derived from the disintegration and decomposition of the underlying rocks. In all of these residual soils a most intimate relation exists between the nature of the soil and the lithologic character of the bedrock below. Where the parent rock is one of the coarser, rather massive sandstones the soil resting upon it—for example, the light phase of the Windthorst fine sandy loam—is extremely coarse, while the finer textured soils, such as the typical Vernon fine sandy loam or the finer areas of the mesquite phase of this soil, are underlain by the finer massive sandstones, from which they have been derived. Where the underlying rock is a thin-bedded sandstone interstratified with clay or shale beds, the soil is a heavy, fine sandy loam, loam, or clay loam, depending upon the relative proportions of clay and sandstone in the parent formations. When the bedrock consists of clay or shale its sandy or friable nature determines largely whether its soil type derivative will be a clay, clay loam, or loam. The areas underlain by beds of conglomerate and clay, or conglomerate, clay, and sandstone, may be clay, clay loam, loam, or fine sandy loam. If the conglomerate is largely calcareous material, its residuum may be clay, but if it contains a high percentage of insoluble particles in the form of quartz, it may decompose into a sandy clay loam, loam, or fine sandy loam, depending upon the proportional amount of fine sand. The former condition may have prevailed in parts of Black Flat and the surrounding country, where the Greensburg clay, Kirkland clay, and Kirkland clay loam are represented; but in most places the conglomerate is overlain or closely associated with a clay bed, which undoubtedly played an important part in the origin of these heavier soils. In sections of the county where limestone or sandstone, clay, shale, or conglomerate

running high in calcium carbonate constitutes the parent formation, the resulting soil material is always rich in calcium carbonate and generally in humus. Poorly drained areas, where organic matter has accumulated in the presence of water, also show a high content of humus.

Soils indirectly related to the bedrock formations of the county are those occupying the present flood plains and the higher terraces, having their origin from the weathering of the materials of which these plains are made up. Each stream, no matter what its size may be, deposits the coarse material where the current is swiftest and the fine where it is sluggish, so that rocks are found under the stream current, gravel and coarse sand outside, fine sand in the natural levees, and silt and clay out in the flood plains. As the waters subside and the velocity becomes less, coarse sand is deposited over gravel, and very fine sand over fine sand, thus developing stratification. Following the natural law of assortment, the small valleys with their steeper grades contain the Miller very fine sandy loam and the larger valleys, with their broad flood plains, the Miller clay and clay loam.

The higher bottoms are the remnants of the old flood plains, which have been left above present high-water marks, either on account of a more advanced stage being reached in the development of the valleys or because of uplift.

The soils of Archer County may be divided into two general groups, the smaller consisting of the bottom-land or fluvial soils, and the larger including the upland or residual soils. In the first occur two series, the Bastrop, occupying the terraces or old flood plains, and the Miller the present flood plains. The Bastrop is represented by two types and the Miller by four, the type distinctions being based upon texture. In the upland division there are four series, the Vernon, Windthorst, Kirkland, and Greensburg. The striking characteristics upon which the series differences are mainly based is the color of the soil and subsoil, the Vernon having a reddish-brown soil and subsoil; the Windthorst, a reddish-yellow and brown soil and mottled red and yellow subsoil, the Kirkland a dark-brown soil and subsoil, and the Greensburg a black soil and dark-brown subsoil.

While the Vernon fine sandy loam exceeds all other types in cultivated area, a greater proportion of the total area is cultivated in the case of the Greensburg clay, Greensburg clay loam, Greensburg loam, Vernon loam, Kirkland silty clay loam, and Bastrop very fine sandy loam. Of all the types the Vernon clay has the smallest area in cultivation.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Vernon fine sandy loam.....	177,856	31.4	Miller clay loam.....	12,096	2.1
Vernon clay loam.....	79,104	14.0	Kirkland clay.....	9,472	1.7
Vernon clay.....	29,312	12.3	Miller very fine sandy loam.....	8,512	1.5
Eroded phase.....	40,448		Greensburg clay loam.....	6,976	1.2
Vernon loam.....	49,216	8.7	Rough stony land.....	4,160	.7
Miller clay.....	46,080	8.1	Greensburg clay.....	4,032	.7
Kirkland clay loam.....	23,872	4.2	Greensburg loam.....	3,776	.7
Windthorst fine sandy loam.....	21,120	3.7	Kirkland fine sandy loam.....	2,176	.4
Bastrop loam.....	18,816	3.3	Bastrop very fine sandy loam.....	960	.2
Miller loam.....	14,720	2.6			
Kirkland silty clay loam.....	14,336	2.5	Total.....	567,040	

GREENSBURG CLAY.

The soil of the Greensburg clay is a dark-gray to black calcareous clay, containing a relatively large proportion of silt, and from 5 to 8 inches deep. It is ash gray when dry, becoming black, sticky, and tenacious when wet. The soil contains a large quantity of organic matter and a few quartz or flint pebbles and calcareous particles derived from the underlying conglomerate. These are never present in quantities sufficient to give the soil a coarse texture.

The subsoil is a plastic silty clay. The color is lighter than that of the soil, being more of a grayish brown or dark gray, although in places it is almost black. It contains a higher amount of calcareous particles or accretions than the surface soil. Its texture and structure are favorable for the retention of moisture during dry periods. At depths of 30 to 32 inches rock fragments of a calcareous nature are usually encountered and the subsoil as a whole shows a lower moisture content. In only a very few places has complete decomposition of the rock extended to depths greater than 3 feet.

The type includes some brown spots in which the soil is loose and loamy and contains a larger amount of coarse, calcareous fragments than the blacker soil. These are not similar to the alkali spots of the Vernon type, as the plant growth on them is good and the soil is loose and pulverulent. They possibly represent the former sites of prairie-dog holes, the lighter color and coarser texture being due to subsoil excavated by these animals.

On account of its fine texture and high clay content the soil becomes hard and compact at the surface, but under cultivation a good tilth is maintained, and even when the soil is plowed wet it subsequently becomes loose and mellow.

The Greensburg clay occupies a total area of 6.3 square miles, and is confined to two localities, one about 6 miles southeast and the other about 5 miles southwest of the town of Dundee, these areas

being known, respectively, as the Black Flat and the Rice School or Rice Ranch land. In both of these areas the type occupies a high level upland or small plateau. Although the land is very level or flat, the rainfall in this section of the State is small and there is no lack of drainage.

The soil is residual from clay beds and calcareous conglomerate, which are represented only on the higher land in the northwestern part of the county. This rock is composed principally of rounded and angular fragments of impure limestone, sandstone, and limonite or hematite, with a small percentage of quartz or flint pebbles, cemented by calcium carbonate and iron oxide.

The Greensburg clay was originally a treeless prairie, supporting a rank growth of the native grasses. On the few small tracts left uncultivated mesquite is the only tree growth.

Practically all of the Greensburg clay is in cultivation. The large supply of humus, the high lime content, the power of the soil and subsoil to retain moisture, and the level topography make it one of the best farming soils in the county. Cotton, oats, wheat, kafir, sorghum, and milo are the principal crops, and the average yields are reported to be higher than on the Vernon and Kirkland types. During the most favorable years yields of three-quarters to 1 bale of cotton, 40 to 50 bushels of oats, 30 to 40 bushels of kafir, and 30 to 40 bushels of milo per acre are obtained without the use of fertilizers. Some of this land has been in cultivation for 20 years or longer. Wheat was formerly the principal crop, yields of as much as 30 bushels per acre being obtained. On account of a marked decline in the yields of wheat, cotton for the last 6 or 8 years has displaced wheat as the principal crop.

Although this soil is naturally very fertile, careful methods of farming are necessary to obtain the best results. Deep plowing followed by shallow harrowing after rains must be practiced to counteract the effects of droughts.

The present selling price of the land is \$30 to \$35 an acre.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil of the Greensburg clay:

Mechanical analyses of Greensburg clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443606, 443668.....	Soil.....	0.2	0.3	0.3	4.3	19.0	48.8	27.0
443607, 443669.....	Subsoil.....	.5	.5	.2	2.8	13.0	47.1	35.9

GREENSBURG LOAM.

The surface soil of the Greensburg loam consists of a dark-brown loam, with a depth of 8 to 10 inches. The subsoil below 10 inches is a slightly grayish brown, dark-brown, or drab clay or compact clay loam, which continues to a depth of 3 feet or more. A somewhat lighter grayish brown, dense clay is often encountered at a depth of 30 inches.

The dark color of the surface indicates a high content of organic matter, and this with its loose structure makes the soil easy to cultivate. The arrangement of a loamy surface soil resting on a heavier subsoil, makes this type well suited for absorbing and retaining moisture, and experience has shown that it is much easier to conserve moisture in the case of this soil than it is with the heavier types.

The Greensburg loam is associated with the Greensburg clay loam, and is practically the same in elevation, and surface characteristics. It occurs near the South Fork of Little Wichita River, the Greensburg clay loam lying between it and the river, and forms a transition type between this soil and either the Windthorst fine sandy loam or the Vernon fine sandy loam. One small isolated area was mapped on a hill about 2 miles south of Megargel. In places the surface is a little more broken than is typical of the clay loam type.

Some of this soil is cultivated, though much of it is used only for grazing. About the same crop yields are obtained as on the Greensburg clay loam, except that corn does somewhat better.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Greensburg loam:

Mechanical analyses of Greensburg loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
443674.....	Soil.....	Per cent. 0.1	Per cent. 0.1	Per cent. 0.9	Per cent. 28.8	Per cent. 20.2	Per cent. 26.3	Per cent. 23.0
443675.....	Subsoil.....	.0	.4	1.0	30.0	15.1	25.8	27.4

GREENSBURG CLAY LOAM.

The surface soil of the Greensburg clay loam consists of a dark-brown to nearly black, rather heavy clay loam to a depth varying from 8 to 10 inches. This is underlain by a dark-gray to drab compact clay loam or clay, which becomes more dense and somewhat lighter in color with increase in depth. Both surface soil and subsoil

carry varying quantities of irregular lime concretions, varying from the size of a wheat grain to that of a pea. For a soil of this texture an especially soft, granular, and mellow tilth is obtained in cultivation. This characteristic probably is due to the high content of humus and lime. While the supply of humus increases the capacity of the soil for moisture, the careful maintenance of a soil mulch is necessary. This is easier than the case of the Vernon and Kirkland clay loams.

This type comprises a few small areas on the elevated table-land bordering the basin drained by the headwaters of the South Fork of Little Wichita River. Some of it is found on the western side of this basin but more on the southeast side, between Terrapin and Cottonwood Schools. While the western tracts are isolated, the eastern developments are but the northern projections of a much larger area of the type lying in Young County. This soil is distinguished from the Kirkland clay loam mainly by its uniformly darker color, more level and smoother surface, and more elevated position.

A large part of the surface is flat, the type as a whole varying from nearly level to slightly rolling. No rock exposures are found, though occasionally on some of the more prominent rises, marked by a grayer color, bedrock is reached within 3 feet. On virgin land of this type, particularly in low-lying situations, slight depressions 4 to 6 feet or more across frequently occur. These are sometimes known as "hog wallows," and are said to be the result of cracking of the soil on drying out. When plowed these depressions generally disappear and a smooth surface is maintained. Drainage is usually ample.

This soil, which is of residual origin, is derived from heavy calcareous clay beds interstratified with beds of calcareous sandstone, the clay predominating. The level surface as well as the very calcareous nature of the parent material, has favored the accumulation of organic matter, with which the soil is well supplied.

A considerable proportion of this soil is now under cultivation and excellent crops are obtained. Cotton, the principal product, gives good returns. One bale per acre is not an infrequent yield even in seasons of limited rainfall, although one-third to two-thirds bale represents the ordinary range of yields. Corn is fairly successful. Unless care is taken to conserve moisture and secure an early maturity, the crop is likely to fail. In the better years a yield of 30 to 35 bushels is not uncommon. Small grains do well. Wheat is generally a sure crop, yielding from 15 to 25 bushels per acre. Oats will produce from 35 to 40 bushels per acre in an average year, and as much as 50 bushels has been secured. Forage crops are not grown very extensively but the soil is well adapted to their production.

Improved land of this type is valued at \$30 to \$40 an acre.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil and a single analysis of the lower subsoil of the Greensburg clay loam:

Mechanical analyses of Greensburg clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443603, 443678.....	Soil.....	0.1	0.1	0.3	7.8	15.1	51.1	25.4
443604, 443679.....	Subsoil.....	.1	.2	.2	6.3	14.8	41.9	36.4
443605.....	Lower subsoil.....	.5	.5	.2	5.8	10.3	47.2	35.2

BASTROP LOAM.

The soil of the Bastrop loam is a loam to very fine silty sandy loam from 7 to 12 inches in depth. The color is medium brown to dark brown, showing a reddish tinge when dry. The soil is somewhat variable in texture, and in depressed areas approaches a silt loam. The color in such areas is darker—a dark brown to almost black. Below the surface soil for a few inches a chocolate-brown silt loam usually appears. This grades at 15 to 20 inches into a chocolate-brown to chocolate-red clay loam, which is underlain by a heavy, sticky, compact clay of similar color. Calcareous particles, accretions, and concretions are numerous in this clay, and where concretions are found the clay itself is rich in lime. In some areas, the heavy clay appears in spots at the surface. These spots often contain considerable quantities of alkali and are reputed to be especially unproductive in dry seasons.

The Bastrop loam is developed along Hollidays Creek. It occupies a belt from 1 to 2 miles wide in the present flood plain of the stream. The surface lies from 6 to 15 feet above the mean level of the stream. An arm of this area extends up Panther Creek to a point about 1½ miles northwest of Geraldine School.

This type occupies distinctly flat country and has poor natural surface drainage. Drainage has, in a measure, been improved by open ditches. Ridge cultivation is also used. Erosion has scarcely started.

Mesquite is about the only tree growth on this type. Curly mesquite is the predominating grass.

The crops obtained on the Bastrop loam compare very favorably with those of the Vernon fine sandy loam, except where the clay subsoil approaches the surface. Such places, without very deep plowing, thorough pulverization, and much care, will not absorb and retain an adequate amount of moisture to supply the crops during a drought. A 22-year record kept by one farmer who plowed to a depth of 3 to 5 inches and used extensive methods, shows

14 years of very low yields on account of drought and hot winds, while the average yields for the remainder were 25 bushels of corn, 35 bushels of oats, 22 bushels of wheat, and one-third bale of cotton per acre. During 1911, which was the most droughty year in the history of the locality, one farmer sowed wheat on a 4-acre tract which had been double listed early in the season to a depth of 12 inches and subsequently well pulverized and harrowed after rains. The yield was 13 bushels per acre, while an adjoining field of similar character handled in an extensive manner, produced less than 4 bushels per acre. Another farmer, by breaking to a depth of 8 to 10 inches, has had 6 fair to good crops in the last 9 years, the yields of corn ranging from 15 to 45 bushels, of wheat from 14 to 20 bushels, of oats from 35 to 45 bushels, and of cotton from one-third to three-quarters bale per acre. Other examples could be given, but these are sufficient to show the advantages of careful farming.

One requisite to the proper handling of such land and one that is practiced, even by the best farmers, to a very small extent, is the application of stable manure or the plowing under of some green crop, preferably a legume. The incorporation of humus in the soil will not only improve its tilth, making it loamy, mellow, and more pulverulent, but will greatly increase its capacity to absorb and retain water and assist in the maintenance of a surface mulch. Patches of heavy, stiff, compact clay soil containing alkali are found in this type. They should be handled as described in the chapter on agriculture.

In Wichita County a number of farms on the Bastrop loam are being irrigated successfully from Wichita Lake. Even with irrigation careful cultural methods are necessary. During 1911, an unusually dry year, one irrigation farmer, by careful cultivation, produced over 1,400 pounds of seed cotton to the acre, while on a similar irrigated soil, with extensive methods, his neighbor only produced 1,602 pounds on 10 acres, and another farmer 1,808 pounds on 6 acres.¹ Corn, wheat, and oats also do well with proper methods. Peaches and berries produce large yields of excellent quality, while both were almost complete failures on the nonirrigated land.

From another irrigating reservoir, situated 3 or 4 miles west of the Geraldine School near the source of Panther Creek, or south of Mankins along Hollidays Creek, an area of 25 square miles could readily be covered by canals. A large part of this land is an extension of the area now being irrigated near Wichita Falls.

The selling price of the Bastrop loam ranges from \$10 to \$40 an acre. Were irrigation systems installed a much higher price would be attained.

¹ Figures from plat tests made in Wichita County, under the direction of the Bureau of Plant Industry,
S. W. Campbell, field agent.

A phase of the Bastrop loam is developed in detached areas occupying old alluvial terraces, 8 to 13 feet above the present flood plains, along the South and Middle Forks, the Little Wichita River proper, the West Fork of Trinity River, and along Onion Creek.

This phase consists of a dark-brown to reddish chocolate brown fine loam or silt loam, carrying but little material coarser than fine sand. At a depth of about 12 inches the soil grades into a chocolate-colored sandy clay loam. Calcareous particles are encountered at 14 inches and become more numerous with increasing depth. A heavy, compact clay is reached at about 20 inches. This is slightly redder than the material above. It continues to about 3 feet, except in a few instances where stratified beds of rounded gravel and sand are encountered at less depth.

The surface is flat, but the drainage, except during very wet seasons, is adequate.

As farming land this phase is equal to the better grade of the Vernon fine sandy loam. Its friable and mellow surface soil and sandy clay loam subsoil make it especially suited to dry-farming practices. To produce the best crops about the same methods should be used as suggested for the Vernon fine sandy loam. The same crops are grown. The general yields average a little higher than those from the Vernon fine sandy loam, corn ranging from 20 to 30 bushels, oats 25 to 35 bushels, wheat 12 to 18 bushels, kafir 35 to 45 bushels, milo 35 to 45 bushels, and cotton from one-third to three-quarters bale per acre.

No farms are composed exclusively of this phase. The estimated value of the land is from \$15 to \$40 an acre.

The following table shows the average results of mechanical analyses of samples of the typical soil and subsoil of the Bastrop loam:

Mechanical analyses of Bastrop loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443639, 443680, 4436105	Soil.....	0.0	0.2	0.4	11.6	30.9	40.9	15.8
443640, 443681, 4436106	Subsoil..	.3	.3	.4	8.7	18.1	40.2	31.9

BASTROP VERY FINE SANDY LOAM.

The Bastrop very fine sandy loam consists of a very fine sandy loam to loamy very fine sand of a light chocolate red color. It is comparatively uniform in both color and texture to a depth of 8 to 12 feet, though a very slight change in color occurs at 12 to 14 inches. A few gully exposures show a sandy clay in the deep subsoil. The clay content in both the soil and subsoil is greater near the foot of the escarpments, back from the Wichita River. The basal part of

the alluvium as shown in the river bank exposures is mainly a coarse crossbedded sand.

Only a small area of the Bastrop very fine sandy loam is developed. The type is confined to the valley of the Wichita River, in the extreme northwestern part of the county. It occupies alluvial terraces, lying 30 to 35 feet above the channel of the river, the terraces forming two narrow belts, about four miles in length, on each side of the stream. The alluvium is eroded by the river, which has constantly shifted its channel and now meanders from side to side so that the line marking the terrace escarpment is irregular. In places the cutting of the stream has almost completely obliterated the higher terraces.

The soil is derived from old alluvium which lies well above the more recent alluvial deposits or flood plain, and is not subject to overflow.

A scattered growth of elm, hackberry, Chinaberry, and mesquite is found on this soil, the trees being somewhat smaller than on the adjacent bottom land. The type supports a good growth of grass.

This soil is easily cultivated, and notwithstanding the high sand content seems to hold moisture fairly well. The yields of cotton, corn, and oats compare favorably with those obtained on the other soil types of the county. Yields of three-fourths of a bale of cotton, 50 bushels of oats, and 40 to 50 bushels of corn per acre are obtained in the more favorable years, but the average yields are hardly half as great.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Bastrop very fine sandy loam:

Mechanical analyses of Bastrop very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443649.....	Soil.....	0.0	0.0	0.1	4.1	57.8	24.0	13.9
443650.....	Subsoil.....	.0	.0	.3	10.2	49.7	27.0	12.7

KIRKLAND FINE SANDY LOAM.

The surface soil of the Kirkland fine sandy loam is a medium to dark-brown friable fine sandy loam containing much organic matter and having a depth of about 11 inches. This material changes to a loam, and at about 14 inches to a friable clay loam of a chocolate-brown color. Below this lime concretions and fragments averaging about the size of a pea appear. At a depth of 24 to 36 inches the material is a yellowish-brown clay, slightly streaked with yellow.

Only a small total area of this type is found in the county. It occurs as small patches, ranging from a few acres to 50 acres in extent. The main developments lie in the vicinity of Cottonwood and Harrison Schools and northwest of Scotland.

The surface of the Kirkland fine sandy loam is flat to gently undulating. Where it is associated with the Vernon fine sandy loam it occupies shallow drainage depressions. In these the humid conditions have favored an accumulation of vegetation, which has produced the dark color.

The origin of the soil is due to the weathering of sandstone, with possibly some admixture of materials derived from clay beds.

For farming purposes this type is comparable to the Kirkland silty clay loam, ranking as one of the best soils of Archer County. It is somewhat easier to cultivate than the silty clay loam.

The following table gives the results of the mechanical analyses of samples of the soil and subsoil of the Kirkland fine sandy loam:

Mechanical analyses of Kirkland fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443637.....	Soil.....	0.0	0.2	0.3	16.1	27.7	35.8	19.9
443638.....	Subsoil.....	.1	.1	.3	12.4	26.9	29.7	30.3

KIRKLAND CLAY LOAM.

The Kirkland clay loam consists of a thin layer, about 1 inch thick of dark-brown fine sandy loam resting on clay loam of the same color and 7 inches in thickness. In some poorly drained depressions and areas of flat surface the color is almost black, owing to the greater accumulation of organic matter in such places, while where the surface is rolling and erosion has been active, a variation to reddish or yellowish brown color takes place. The subsoil is a heavy, stiff, plastic, chocolate-brown or dark reddish brown clay which, at about 14 inches, is sufficiently calcareous to effervesce with hydrochloric acid. Accretions and concretions, running high in calcium carbonate, are also present, becoming more numerous at greater depths, and producing in the clay a rather friable structure at 24 to 36 inches.

The most extensive bodies of this upland type are found between Geraldine School, Holliday, and the west county line, while smaller areas occur in and around Megargel. Small isolated spots are found in other sections of the county.

In almost all cases the surface is either gently sloping or flat. Near Geraldine School the type seems to be derived from beds of calcareous clay, or from interbedded strata of clay and thin layers of sandstone. On the plateau northwest of Dundee the parent formation is a brown calcareous clay interstratified with thin-bedded limestone, and southeast and southwest of Dundee it is clay intermingled with calcareous conglomerate. Two factors seem to account for the high content

of humus which imparts the dark color to this soil. Probably the most important is the flat to gently sloping surface, where the moist conditions cause a luxuriant growth of vegetation and the accumulation of organic matter in the presence of water; the other is the high content of lime, which is believed to favor the humification of organic remains incorporated in moist soil.

The vegetation on this soil as a whole is identical with that of the Vernon clay loam, and includes mesquite trees, chaparral growths, prickly pear, and cob and turnip cacti. Grazing is supplied mainly by the curly mesquite grass. Early pasturage consists of running mesquite, wild rye, and needle grass.

With the exception of the areas around Megargel, little has been done in tilling this soil. It is a more difficult soil to keep in good tilth than the more sandy soils, but is more easily handled than the Vernon clay loam, owing to the fact that it does not run together so badly after rains. Undoubtedly the organic matter present accounts for this superiority.

During the last three years fair crops have been grown only where more careful methods of cultivation have been followed. Without early deep plowing, thorough pulverization, and constant cultivation to prevent evaporation, good yields can not be produced except in seasons of ample rainfall. With proper moisture conditions and careful cultivation wheat has yielded from 25 to 30 bushels per acre, oats from 45 to 50 bushels, and cotton from one-half to 1 bale; but the general average is considerably below these figures. Forage crops, such as kafir and sorghum do very well, and the grain yield of kafir and milo is from 40 to 45 bushels per acre.

The selling price of farms located on this type ranges from \$15 to \$40 an acre, depending largely on improvements and transportation facilities.

The following table gives the average results of mechanical analyses of samples of soil and subsoil of the Kirkland clay loam:

Mechanical analyses of Kirkland clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443645, 443651.....	Soil.....	0.2	0.2	0.3	3.3	24.4	46.6	24.6
443646, 443652.....	Subsoil.....	.9	.8	.4	2.0	11.9	44.8	39.0

KIRKLAND CLAY.

To a depth of 1 to 3 inches the Kirkland clay is a dark-brown to almost black clay loam. This lighter surface material grades into a dark-brown, refractory, calcareous clay, containing small lime

concretions. In places the soil is a fine sandy loam 1 or 2 inches deep, grading into a clay or silty clay. The depth of the surface ranges from 4 to 10 inches. The topographic features control, in a great measure, both depth and color, the low, poorly drained plains having the darker color and deeper soil and the eroded slopes lighter color and shallower soil, the original surface having been largely removed. With increase in depth the heavy, compact clay becomes lighter in color and the lime concretions and calcareous fragments more numerous. At from 24 to 36 inches the color is chocolate brown.

The total area covered by this type is small, the two main areas, which are level or flat, lying west and south of Dundee and northwest of Geraldine School.

The type is residual in the Geraldine School region from the heavy, compact beds of calcareous clay; in the Dundee area in part from thin beds of limestone or a calcareous conglomerate interbedded with the clay.

In all cases mesquite and chaparral and cacti growths are abundant. Grasses do well, especially the curly mesquite.

Only very small areas of the type are under cultivation. These have given some fair yields, but because of the heavy, intractable, and compact nature of the soil much labor is necessary to bring the land into good condition. The soil requires early deep breaking, followed by deep harrowing and then shallower harrowing after rains. In this way, owing to the high humus content, an excellent seed bed can be maintained, as the soil material tends to granulate and assume an open structure. It does not run together badly under cultivation, and is thus superior to the Vernon clay. Since the soil is too heavy and compact to absorb the moisture necessary for farming without intense and thorough cultivation, it is almost useless to attempt the tillage of this type with careless methods, because only in years of well-distributed rainfall could a profitable crop be obtained. With proper methods of cultivation the general farm crops of the region can be successfully grown. The land is well adapted to grazing, as it supports an excellent growth of curly mesquite.

The following table gives the results of mechanical analyses of samples of soil and subsoil of the Kirkland clay:

Mechanical analyses of Kirkland clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443641.....	Soil.....	0.1	0.2	0.3	4.0	14.9	40.7	39.8
443642.....	Subsoil.....	.4	.9	.4	5.5	11.3	42.1	39.4

KIRKLAND SILTY CLAY LOAM.

The surface soil of the typical Kirkland silty clay loam is a dark chocolate brown, mellow, pulverulent clay loam, 8 to 12 inches in depth. When approaching the Vernon types it generally shows a lighter shade of brown, with a reddish tinge. It generally contains no material coarser than sand, but in places in the northwestern part of the county water-worn quartz pebbles are abundant. Calcareous accretions derived from the underlying formation are also present in places, the prairie dogs having carried them to the surface. Immediately beneath the soil is a dark-brown or dark chocolate colored clay loam, which grades into a heavy, compact and calcareous clay of about the same color. At about 16 inches calcareous concretions appear.

In extent the type is one of the less important soils of the county. The largest areas lie in the northwestern part of the county along Hollidays Creek and about the headwaters of Panther Creek. Smaller areas are developed in other sections of the county.

Along Hollidays Creek, although there is a suggestion that a portion of the type may possibly be an alluvial terrace, the main body is apparently residual from the calcareous conglomerate, sandstone, and clay underlying it, while at the head of Panther Creek it seems to be an admixture of residual material from the underlying clay and sandstone, with colluvial material from the higher areas that border it on three sides. There is also an admixture of some old alluvium along Panther Creek. The other areas, which are merely low sags or flats at the heads of small drainage courses, are residual from the underlying sandstone with some colluvial material from adjacent uplands. The darker color in these areas is due to the greater accumulation of organic matter under the moist conditions. As a whole, the type is poorly drained, but owing to the dry climate, little difficulty is experienced because of this feature. However, open ditches or tiling would be of service during periods of excessive rainfall.

Mesquite is the only tree growth, while the grasses of the surrounding types grow especially well on this land.

Taking an average for 10 or 15 years, probably the best crops of the county have been grown on this soil. Its high content of humus and very fine sand makes it the most absorptive of moisture of all the types, while its naturally mellow, loamy surface constitutes a retentive mulch. Yet, even with these natural advantages if careless methods are employed there is only an even chance that crops will succeed. One farmer, by breaking the soil in August to a depth of 6 inches with a disk plow, then harrowing well and following this process by shallow cultivation after rains, secured during the period, 1897 to 1907, the following yields: Wheat from 10 to $28\frac{1}{2}$ bushels,

corn 10 to 50 bushels, oats 15 to 75 bushels, and cotton, one-fifth to 1½ bales per acre. He also produced excellent crops of millet, kafir, and milo. A very early variety of corn was selected in order that it might mature before the time of hot winds. Because of the natural mellowness and mulching of the soil, very deep plowing is not so essential as in the case of other types, yet one farmer who double listed the soil to 6 inches and subsoiled 10 inches deeper late in the summer, harvested the best crops of corn and milo produced in Archer County during the following year.

A distinct silty phase of the Kirkland silty clay loam appears along Hollidays Creek, eastward from Dundee. The area occupies a belt from one-fourth to 2 miles wide along the stream. It has a dark to light brown or chocolate-brown to dark-gray color, and varies in texture from a very fine sandy loam to a rather heavy silty loam. In some places a tendency to crust over or run together is characteristic. The soil has a relatively large content of organic matter and a depth of 8 to 12 inches. The subsoil is a medium-brown or dark chocolate brown silty clay, which becomes very hard and compact when dry. At depths between 20 and 30 inches, the color becomes lighter and redder and carries a greater quantity of calcareous rock fragments. Both soil and subsoil effervesce with hydrochloric acid. The spots in which the crusting occurs are bare and unproductive, except at times of abundant rainfall, when crops grow and mature. The treatment of such spots is discussed in the chapter on agriculture.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil of the Kirkland silty clay loam:

Mechanical analyses of Kirkland silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443656, 443664, 443684.	Soil.....	0.1	0.6	1.4	7.6	23.8	41.6	24.8
443657, 443665, 443685.	Subsoil..	.3	.6	1.2	7.5	15.7	39.9	34.7

MILLER CLAY LOAM.

The typical Miller clay loam is a reddish-brown to dark chocolate brown silty clay loam to clay loam, underlain at 6 to 10 inches by a heavier clay loam of a deeper chocolate red color, but all gradations from a heavy loam to a light clay are present. The color depends on the topographic position, being darker in depression on account of a higher content of organic matter. The subsoil is as variable as the surface, sometimes being a clay loam throughout, and in other places grading into a clay, silt, fine sandy loam, very fine sandy loam, or loam. Numerous patches of types of other textures are found,

their arrangement sometimes being so complex that the determination of the predominating type is necessarily arbitrary. It is likely that Meadow would be a more appropriate classification for such places, but because of their close association with the better marked clay loam areas and their limited extent it has seemed best to include them with the Miller clay loam in this instance.

The type is developed in the bottoms along medium-sized streams, and occupies a position next to the channel or between the very fine sandy loam of the natural levees and the heavy clay lying farther away from the streams. Of the flood-plain soils it is second only to the Miller clay in extent.

This soil has originated from the weathering of materials laid down by the streams during floods. The deposits have been derived from the interbedded clay and sandstone beds of the upland. Its variability in texture is due to the assorting power of currents of varying velocity.

The natural vegetation is similar to that of the Miller loam. With normal rainfall and protection from overflow, good yields of cotton, corn, oats, grass, and forage crops can be obtained, although only a small area of this type has so far been cultivated. In order to secure the best results the same methods of tillage should be practiced as on the Vernon clay loam. A surface mulch is somewhat more easily maintained in the alluvial soil because of the more silty character of this soil. On account of poor drainage, ditching and ridge cultivation would be advisable, though not absolutely necessary, in most seasons. The type is admirably situated for irrigation, and would without doubt give results comparable to those of the Bastrop very fine sandy loam about Wichita Falls.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Miller clay loam:

Mechanical analyses of Miller clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443688.....	Soil.....	0.0	0.5	0.2	8.5	18.1	47.1	25.6
443689.....	Subsoil.....	.0	.1	.1	4.3	15.0	53.1	27.2

MILLER LOAM.

The typical surface soil of the Miller loam consists of 8 to 10 inches of a chocolate-brown loam, containing a relatively large proportion of silt. The subsoil, which is a slightly lighter shade of chocolate brown or reddish brown, is a clay loam or silty clay loam, but is not so dense as the subsoils of the Vernon series. Occasional spots in

which the soil is a heavy, compact clay, or seems to run together and harden after a rain, are seen, but these are less common than in the upland.

The Miller loam is developed as narrow bands in the flood plains of the smaller stream courses, the largest areas occurring between Table Branch and the South Fork of Little Wichita River and along Bitter Creek. The type seldom has a uniform development, but is streaked and spotted with both the very fine sandy loam and clay loam of the same series.

Only a small percentage of this soil has been put under cultivation, but where it has, yields equal to and even a little better than those of the Vernon fine sandy loam are obtained. Owing to its natural surface mulch and its loose, loamy character the soil is easily cultivated. Farmers report that crops start more quickly and make a ranker growth of stalk than on the Vernon fine sandy loam. All of the general crops of the region are grown, though cotton probably predominates.

The vegetation of larger growth consists mainly of mesquite and chaparral, except close to the streams, where live oak, elm, ash, hackberry, cottonwood, and Chinaberry are seen. The curly mesquite and other grasses do well.

For growing garden truck under irrigation, this soil will compare favorably with the Miller very fine sandy loam.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Miller loam:

Mechanical analyses of Miller loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443676.....	Soil.....	0.1	0.1	0.5	16.0	27.6	36.3	19.1
443677.....	Subsoil.....	.1	.3	.2	11.8	20.2	35.4	31.8

MILLER VERY FINE SANDY LOAM.

The Miller very fine sandy loam in its typical development is a reddish-brown or dark chocolate brown very fine sandy loam, the depth of color depending on the content of organic matter. At about 14 inches the soil grades into material of lighter color, showing some mottling with light yellow, which becomes more conspicuous with increasing depth. The texture remains the same to depths of 18 to 22 inches, where a very fine sandy clay is encountered which at about 30 inches passes into a silty clay loam to silty clay. The color of these heavier strata is reddish brown. Although this description fits the average of the type approximately, there are a number of

variations. In places the soil consists of a heavy fine sandy loam, underlain at a depth of 6 or 7 inches, by a clay loam which at about 10 inches passes into a heavy, stiff clay, while in other places the soil is a loose fine sand extending to a depth of about 36 inches. Here it may grade abruptly into a silt loam. No uniformity of texture or structure seems to persist over areas of considerable size.

The Miller very fine sandy loam forms the natural levees along the larger streams and the entire bottoms of small valleys in the sandy regions, like the broom-sedge section. The total area of this soil is 13.3 square miles.

This soil is easily cultivated. The yields equal those of the Vernon fine sandy loam. One farmer, in the late summer of 1909, double listed 4 acres of this land to a depth of 10 inches and then subsoiled it 12 inches deeper. The following spring he planted cotton, and, although the season was very droughty and many crops failed, the yield from this tract was three-fourths bale to the acre. This illustrates the results which may be obtained through careful farming. Garden products do exceptionally well on this soil.

The position of the principal areas of this soil in the flood plains of small creeks would make irrigation a simple matter. A dam built across the valley would retain sufficient water to irrigate gardens during the most prolonged periods of drought.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil and a single analysis of the lower subsoil of the Miller very fine sandy loam:

Mechanical analyses of Miller very fine sandy loam.

Number.	Description.	Fine	Coarse	Medium	Fine	Very fine	Silt.	Clay.
		gravel.	sand.	sand.	sand.	sand.	Per cent.	Per cent.
443635, 443647, 443653.	Soil.....	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
		0.0	0.1	0.2	10.5	49.1	27.8	12.3
443636, 443648, 443654.	Subsoil.....	.0	.0	.4	7.1	32.7	35.0	24.6
443655.....	Lower subsoil..	.0	.1	6.7	48.7	30.0	7.2	7.0

MILLER CLAY.

The Miller clay is a dark reddish brown clay to a depth of 2 inches, where it grades into a heavy, plastic clay of the same color, which continues with little change to a depth of 3 feet. Upon drying large cracks are formed and the material breaks down into a buckshot structure. Tests with hydrochloric acid indicate a high lime content in the material below 6 inches. Coarse material is rarely present. On the surface, after inundations, thin, curling films of clay are formed. A fair amount of humus is present, but not sufficient to put the soil in the best possible physical condition. Less typical areas consist of a dark-red very fine sandy or silty clay 7 or 8 inches deep,

underlain by sandy or silty clay of a lighter color and mottled with drab and yellow.

The Miller clay is the most extensive flood-plain soil of the county, its total area being 72 square miles. The principal and most typical areas cover the first bottoms along Little Wichita River and its forks, the West Fork of Trinity River, and Kickapoo Creek. In addition to these areas the soil occurs along the courses of many small streams, especially those traversing the Vernon clay areas.

The Miller clay is derived from recent alluvium in the flood plains mentioned. The deposits are 10 to 20 feet or more in thickness along the larger streams, the flood plains lying at about this elevation above the stream beds. The surface is level or flat, but is dissected by the numerous ditchlike channels of small tributaries of the rivers and by gullies.

The lower bench of the flood plains, immediately along the stream channels, is about the only place trees, other than the generally distributed mesquite and chaparrel, will grow. Here cottonwood, elm, ash, live oak, pecan, hackberry, Chinaberry, mulberry, Chickasaw plum, dogwood, willow, sumac, and a few others thrive. Curly mesquite and the early grasses grow well on these bottoms and afford good grazing. Broom sedge appears in places, but is being displaced by the hardier mesquite.

Although failure has been more common than success in farming this type, the results obtained by a few farmers have proved the possibility of its profitable use. Owing to the compact and impervious structure and its tendency to harden and crack when dry, the type requires early deep plowing and constant cultivation to conserve moisture, but when these methods are used a moist, mellow seed bed very well suited for plant growth may be formed. During the dry year of 1910 some of the best crops of the county were grown on this type, and it seems well adapted to all the more important products of the region. Up to this time, however, these bottoms have been used almost exclusively for grazing, to which they are well suited. This type is well located for irrigation.

Land of this type of soil is valued at \$15 to \$35 an acre.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Miller clay:

Mechanical analyses of Miller clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
443611.....	Soil.....	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443612.....	Subsoil.....	0.0	0.0	0.1	0.4	0.5	32.8	66.2
		.1	.0	.1	.5	1.0	40.4	57.8

VERNON LOAM.

The soil of the Vernon loam consists of a reddish-brown to reddish chocolate brown loam, with a depth of 8 or 10 inches. In places the surface material to a depth of 2 or 3 inches consists of a very fine sandy loam. The subsoil is a friable clay loam of the same general color as the surface soil, but darker in tone. The subsoil is uniform to about 17 inches, where a heavy, compact, yet friable, reddish-brown clay is encountered. At this depth small lime accretions are encountered. The clay itself at this depth gives a strong effervescence with hydrochloric acid, indicating the presence of calcium carbonate. With increasing depth the clay becomes heavier and the limy accretions more numerous. The color at 36 inches often shows a gray cast, and when the bedrock is approached a characteristic mottled orange, red, drab, and black sandy clay or silty material is found.

The soil is very soft and mellow and compares favorably with the Vernon fine sandy loam in ease of cultivation. Its organic-matter content averages higher than that of the Vernon fine sandy loam, which, together with its level surface, makes it more capable of withstanding the effects of droughts and hot winds. When broken too dry or too wet it is more difficult to secure a loose, mellow seed bed, and a more or less cloddy surface results. The areas are interspersed with spots and strips of fine sandy loam, clay loam, and clay, and at times these variations become so numerous that it is difficult to decide the predominating type. The alkali spots discussed in the chapter on agriculture are also present.

The Vernon loam is one of the minor types mapped, but is widely distributed over the county, in all cases being closely associated with the Vernon fine sandy loam. The largest areas lie north of Anarene on each side of Dogwood Creek, in the vicinity of Dundee and between Cob and Deer Creeks. They often form low, rather flat basins, but also lie on slopes or ridges.

The parent formation of the Vernon loam consists of thin beds of sandstone and clay, the decomposition products of the two being so commingled as to produce a loamy-textured soil. The undecomposed rock is generally encountered at 2 to 5 feet below the surface.

A somewhat smaller proportion of this soil than of the Vernon fine sandy loam is farmed. It is an easy type to handle, being neither too sandy nor too compact. The kinds of crops and the yields produced are about the same as those of the Vernon fine sandy loam. It is essential that this soil should be broken more deeply than the Vernon fine sandy loam, in order to get the best results. Early plowing, probably to a depth of 10 or 12 inches, will be found most profitable. Where plowing is delayed much of the rainfall is lost in the run-off. More attention must be given to cultivation than in

the case of a sandier soil, as this soil becomes compact after rains, resulting in the loss of much water by evaporation.

Mesquite is the principal tree growth and the curly mesquite the leading grazing grass, with the broom sedge second.

The selling price of this land varies from \$20 to \$40 an acre, depending on improvements, distance from railroad, and the character of the surface.

The following table gives the results of mechanical analyses of samples of soil and subsoil of the Vernon loam:

Mechanical analyses of Vernon loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443613.....	Soil.....	0.2	0.3	0.3	12.1	34.5	30.1	22.5
443614.....	Subsoil.....	.6	.9	.6	9.9	17.7	47.2	23.0

VERNON CLAY.

The Vernon clay consists of 4 to 7 inches of a dark reddish brown to dark chocolate brown clay. The strength of color is determined by the local topography, being darker in sags or drainage depressions where organic matter accumulates in the presence of moisture. It is darker also in those places where a considerable amount of lime is present. This soil is generally plastic and very tenacious when wet, and when dry it is hard, refractory, and cracks badly, some of the cracks being 3 inches across. Sometimes the soil of the surface inch or two is a clay loam, loam, or fine sandy loam, and in such cases the vegetation shows a better development. The subsoil is a very dense, tough, compact clay of a slightly lighter reddish or chocolate-brown color than that of the surface soil. The calcareous nature of the soil and subsoil is a distinguishing feature of the type. Gray mottlings often appear in the lower subsoil. The line of demarcation between the soil and subsoil is not so sharp as in the other members of the series. Some alkaline salts are probably present in this subsoil, as white efflorescences appear in gullies at depths of 2 to 4 feet.

Vernon clay is extensively developed on the ridges, slopes, and flats along the North, Middle, and South Forks of Little Wichita River and Kickapoo and Briar Creeks. Elsewhere small, isolated, and irregular tracts occur. This soil is found at varying elevations in the uplands of the county, the location being determined by the occurrence of the clay beds underlying it and from which it is derived. Its topographic position is as varied as its elevation, the type appearing along slopes and summits of ridges, around the lower slopes of

mesas, and in rather extensive flat or gently undulating areas. Areas of the kind last mentioned predominate. The surface drainage is in general good, but ranges from excessive on the steep slopes to insufficient in the flats.

Nearly all of this land is devoted to grazing, and because of its heavy nature is not deemed suitable for tilling. If broken to a shallow depth, it will not absorb moisture enough to supply the crops during dry periods. If farmed at all, the type will require the utmost care and most improved methods. Early deep plowing without bringing too much of the subsoil to the surface at one time, thorough pulverization, the addition of humus by applying manures, straw, and other roughage, or plowing under green crops, and shallow cultivation after rains can in no way be neglected. If carefully handled fair crops can be procured, but since so much more labor is necessary than on the lighter soils, it would hardly seem advisable at present to use this land except for grazing. The curly mesquite as well as the early grazing grasses, such as wild rye, running mesquite, and needle grass, grow well on this soil.

Vernon clay, eroded phase.—An eroded phase of the type is mapped. It is more extensively developed than the typical soil. It lies chiefly in irregularly outlined basins below the escarpments, which occur along the main streams of the county. The largest areas are associated with the most extensive and smoother bodies of the typical soil, the phase merely comprising those areas from which the soil has been eroded, leaving the subsoil exposed. The material is so compact and impervious that rain water runs off without being absorbed, and even in depressions where water stands, the soil is dry at a depth of 2 or 3 inches. A section of 3 feet shows a heavy, compact, impervious reddish-brown clay from top to bottom, carrying calcareous concretions and accretions. These sometimes are left on the surface, where the clay is eroded, presenting the appearance of slag. The surface material effervesces with acid. Humus is wholly lacking. When wet this soil is extremely sticky, but when dry it becomes very hard and cracks.

Because of the impervious nature of this soil even the native grasses grow scantily. Stunted mesquite trees and chaparral bushes grow in places, and the prickly pear cactus profusely.

Many of the basins in which this type is found are utilized as pounds, for which purpose they are adapted, owing to their impervious nature and their topographic positions.

The material of the Vernon clay is residual from calcareous clays of the Wichita formation. The soil varies according to the lithologic characteristics of the underlying clay, but the nature and depth of the surface soil are also dependent on the topography.

The smoother areas of the typical soil sell from \$10 to \$20 an acre, while the eroded phase is worth \$3 to \$8.

The following table gives the results of mechanical analyses of typical samples of the soil and subsoil of the Vernon clay:

Mechanical analyses of Vernon clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443643.....	Soil.....	0.4	0.6	0.6	5.6	20.3	38.2	34.2
443644.....	Subsoil.....	.8	.7	.3	3.6	13.7	41.0	39.8

VERNON FINE SANDY LOAM.

The Vernon fine sandy loam has a range in texture from a fine sandy loam to a sand, the latter occurring in small areas only and in localities where the underlying rock is sandstone and lies near the surface. The subsoil varies from a friable clay loam becoming heavier in depth until at three feet it is a clay with calcareous concretions to a light sandy loam where the bed rock lies near the surface.

In color the soil varies from a dark brownish red, the typical Vernon color, through lighter red, yellowish red, brown to light brown in extreme cases. The subsoil is dark brownish red typically and the typical color occurs more often than in the soil, becoming in extreme cases a yellowish brown where it is lightest in texture and the rock lies near the surface.

In topography its area of occurrence ranges from gently undulating, its prevailing topography, to slightly hilly in rarer cases where it occurs in the neighborhood of streams or near the line of one of the prominent escarpments of the region.

An inspection of the map shows that the type occurs principally in two large bodies. The largest body of this soil stretches over the eastern third of the county from the northern to the southern boundary. The other area extends in a wedge-shaped belt, broadest to the southwest from the river junction in the central part of the county to the southwestern corner.

In the northeastern corner of the county extending southward to Lake Creek, the topography is gently undulating, the type is more uniform than elsewhere, and is typical in both color and texture. This area is mainly under cultivation. From Lake Creek to the belt of Windthorst soils extending westward from Prairie Grove School the type is less uniform both in color and texture than in any of the other areas. The topography is somewhat rougher, and on the rougher areas, where the rock is near the surface, the lightest textures and the palest colors occur. It is apparent that this is the poorest phase of

the soil. Very little of it is cultivated. Associated with these rolling lighter areas occur considerable areas of flat land covered with mesquite brush. The soil where this growth occurs is heavier, especially in the subsoil, than either the light-colored soil with which it is associated or the typical soil. It is redder in color also.

In the southeastern corner of the county a small area of the type occurs characterized by a more yellowish red color than the typical and usually a very little lighter texture. In the natural state it was and is covered with a growth of post-oak trees.

The southwestern area is smooth in topography, approximately typical in color, and a little lighter, as a whole, than the typical. It was mainly treeless in its natural state, but a large part of it is under cultivation at present. Especially is this true in the southwestern end of the area.

The important grazing grass of the mesquite phase is the curly mesquite, although small areas of little blue stem and unidentified variety of same species are found, and in early spring, before the curly mesquite is well started, the running mesquite, wild rye, and needle grass afford pasturage. The leaves, tender twigs, and pods of the mesquite trees are also eaten by cattle and sheep.

The Vernon fine sandy loam represents residual products largely formed from the disintegration and decomposition of underlying beds of sandstone. Where the sandstones are thin bedded, the shale beds, which are always interstratified with them, contribute a part of the material. In the case of the post-oak phase of the type the parent rock is correlated with the Pennsylvanian.¹ In all other cases the rock is of Permian age. Probably some of the sandstone beds are Wichita. Since the sandstones of the Permian are, as a rule, finer grained and more calcareous than the Pennsylvanian the soil derived from them is correspondingly finer in texture.

The Vernon fine sandy loam has an undulating to gently rolling surface and is well drained. It occupies the more elevated portions of the county, having a maximum altitude of 1,675 feet at Windthorst and an average elevation of almost 1,200 feet.

The Vernon fine sandy loam as a whole is considered desirable farming land. Under the droughty conditions which ordinarily prevail, this soil has been found to give better results than heavier types. The mellow, sandy surface overlying the heavier subsoil acts as a natural mulch, and materially aids in the conservation of moisture. As the soil is easily cultivated, a minimum labor expenditure is required to grow a crop. It has the disadvantage, however, of drifting when pulverized, and strong winds are likely to injure crops in the early stages of growth by covering the plants, or by blowing the soil away from the roots.

A greater acreage of this type is under cultivation than of any other in the county. Probably 30 per cent of the area is farmed. The remaining land is used for grazing. The more intensive and careful methods of farming have given good results on this type. One farmer by breaking his land deeply either in August or as early as possible, and then harrowing it after each rain, produced profitable crops of corn, oats, and cotton in each of the ten years between 1897 and 1907. The corn yields ranged from 10 to 50 bushels per acre, the yields of oats from 15 to 75 bushels, and of cotton from one-fifth to $1\frac{1}{2}$ bales. Millet, kafir, milo, and sorghum yielded very well. Peaches, plums, and grapes were found to be especially adapted to the more sandy portion of the farm. The size of these crops varied with the occurrence of hot winds and the amount and distribution of the rainfall. The soil was the broom-sedge phase, which runs high in very fine sand and has a sandy clay or clay loam subsoil. On an area of the coarser textured variation of the typical soil a good catch of alfalfa was secured in 1911, one of the driest years in the history of the county. The average yield of the type for a 10-year period is approximately 18 bushels of corn, 25 bushels of oats, 10 bushels of wheat, 35 bushels of kafir, 35 bushels of milo, and one-third bale of cotton per acre.

The formation of a natural mulch on the surface of this soil makes it less essential to break the soil deeply than in case of the heavier soils; yet early breaking to a depth of 10 to 12 inches by either double or triple listing, or deep disk breaking, followed by proper harrowing and cultivation, has resulted in by far better crops. Little attention has been given to the incorporation of organic matter in the soil. The occasional plowing under of a green crop, preferably a legume, will prove an excellent means of improving the soil. Stable manure is an even more valuable organic manure but so little available that green manures will have to be resorted to in providing needed humus. The addition of organic matter will increase the moisture-holding capacity of the soil, produce a soft and mellow structure, in a measure prevent drifting, activate chemical changes and increase bacterial action.

The crops best adapted to this type are those which withstand drought best, such as kafir, milo, and sorghum. With careful preparation of the soil fair yields from these crops are almost certain. Cotton, wheat, oats, barley, and speltz generally yield well where farming is carried on in an intensive manner.

Because of the hot winds, the growing of corn is hardly advisable unless every precaution is observed in storing moisture, since 10 inches of water are required to raise a good crop, $7\frac{1}{2}$ of which are needed during the last 75 days of its growth. This amount of rain hardly ever falls in Archer County during the growing period. Winter

cover crops consume so much of the stored moisture that in most cases they can not be recommended. Sweet clover has been grown successfully on this type in Wichita County, and, being a legume, makes an excellent crop for hay, green manure, and for supplying nitrogen. Peaches, plums, and grapes do very well and could be grown more extensively. Melons and cantaloupes of good quality can be grown with but little trouble. Dewberries and blackberries when carefully cultivated give good results. Garden truck is grown for the home consumption in favorable years. In most cases the irrigation of a one-fourth or one-half acre lot is quite practicable, and would assure a good home garden. By using hotbeds during the cold weather, garden products may be produced throughout the year.

In order to realize the best results, a farmer with 160 acres should, at least, devote half of his attention to stock raising, mainly along the lines of dairying and hog raising. Kafir and Johnson grass make excellent silage, and either is almost a sure crop on this type even during a droughty year.

Land of the Vernon fine sandy loam sells for \$15 to \$40 an acre, depending on improvements, transportation facilities, topography, and nature of the soil.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil of the typical Vernon fine sandy loam:

Mechanical analyses of Vernon fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
443601, 443615, 443627, 443672.	Soil.....	Per cent. 0.1	Per cent. 0.2	Per cent. 0.9	Per cent. 35.5	Per cent. 29.2	Per cent. 22.3	Per cent. 13.9
443602, 443616, 443628, 443673.	Subsoil.....	.2	.6	.7	28.3	21.4	21.0	27.5

VERNON CLAY LOAM.

The surface soil of the Vernon clay loam is a chocolate-brown to reddish chocolate brown clay loam with depth of 5 to 10 inches. In places the soil to the depth of a few inches consists of a loam or even a fine sandy loam. The color is sometimes more of a reddish brown, as in the post-oak region. Occasionally small calcareous concretions, varying in size from that of a wheat grain to that of a hickory nut, occur in the soil, having been brought to the surface by ants or prairie dogs. Where these concretions are present the soil is more friable and easily cultivated. Underlying the clay loam is a dense reddish chocolate brown or brownish-red clay, the color in some

places shading to Indian red or pinkish red. This material also carries small calcareous concretions and accretions and runs high in lime. In some areas the concretions become very numerous, giving the clay a friable structure; but more generally it is heavy, plastic, and compact.

This type occurs in areas of varying size throughout Archer County. The larger bodies lie west of the broom-sedge prairie section, especially south of Hollidays Creek in the north-central part of the county.

The soil overlies and is derived from red clay or shale beds, or from thin interstratified beds of clay and sandstone in which the clay predominates. In places the type is developed where the very fine sandy loam has been washed down over the clay and has become mixed with it. It may occur along ridges, on slopes, or in gently undulating or even flat areas.

In most cases the Vernon clay loam supports a growth of mesquite trees, chaparral, and prickly pear and other varieties of cactus. The prevailing grazing grass is the curly mesquite, to which this soil is well adapted. The running mesquite, needle grass, and wild rye are also important, furnishing early pasturage.

The type is used mainly for grazing, a very small part being cultivated. The largest area under cultivation is in the vicinity of the Newport School, 8 or 10 miles east of Megargel. Good results are obtained, and the land is considered as valuable for farming as the Vernon fine sandy loam. In an average year one-fifth to one-half bale of cotton, 10 to 20 bushels of wheat, and 25 to 35 bushels of oats per acre are produced. With careful handling, and during seasons of abundant rainfall, yields of 1 bale of cotton, 35 bushels of wheat, and 65 bushels of oats per acre have been obtained. Early varieties of yellow dent corn give yields ranging from 20 to 30 bushels per acre. Sorghum, kafir, and milo rarely fail to give fair yields.

The exercise of great care is necessary in breaking this soil. If plowed while too wet, it invariably puddles and clods, but under proper moisture conditions it breaks down into an excellent seed bed. Ordinarily the soil is plowed to a depth not exceeding 3 or 4 inches, and the result is that so little moisture is stored in the soil that the plants cannot withstand a severe drought. This soil, because of its heavy, intractable nature and tendency to run together after rains, is in greater need of careful cultivation than the fine sandy loam, or loam. It should be broken during the late summer, fall, or early winter to a depth of 10 to 12 inches, the disk plow probably being the best for this purpose. The land should then be harrowed deeply in order that pulverization may be thorough, since this increases the water-holding capacity of the soil and provides a better bed for the

rooting of plants. Another very great need is the turning under of barnyard manure or green manuring crops to supply the much-needed humus. Shallow cultivation should be given after each rain, to prevent loss of moisture by evaporation.

Land of this type of soil is valued at \$10 to \$30 an acre, depending on the topography, improvements, and railway facilities.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil and a single analysis of the lower subsoil of the Vernon clay loam:

Mechanical analyses of Vernon clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
443608, 443629	Soil.....	0.1	0.2	0.3	8.4	30.8	34.6	25.3
443609, 443630	Subsoil.....	.5	.8	.4	6.6	20.1	34.9	36.9
443610.....	Lower subsoil...	.6	1.0	.5	6.4	27.0	32.4	32.3

WINDTHORST FINE SANDY LOAM.

The Windthorst fine sandy loam consists of a brown to dark-brown fine sandy loam 8 or 10 inches deep, underlain by a light-brown to drab, plastic, sandy clay which continues to 2 feet or more, where it usually becomes grayer and lighter colored. In the lower 8 or 10 inches the subsoil is mottled with yellow and gray, changing downward to red, orange, yellow, and sometimes black. Fragments of partly disintegrated sandstone are generally present in the lower part of the surface. The underlying rock is often encountered at less than 3 feet from the surface. In some areas this type possesses about the same characteristics as the Vernon fine sandy loam, which is frequently the bordering type of soil.

The Windthorst fine sandy loam is found entirely in the southeastern part of the county, being confined to a nearly continuous belt with an average width of 2 or 3 miles which occupies the divide extending in a northeast and southwest direction between the tributaries of Little Wichita River and those of the West Fork of Trinity River. Its southern boundary is approximately the northern boundary of the forested post-oak section of the county. This divide is the most elevated part of the county. Toward the eastern boundary the elevation is about the same as that of Windthorst, which has an altitude of 1,675 feet above sea level.

The Windthorst fine sandy loam is a residual soil derived from sandstones. The surface is somewhat rolling, but steep or irregular slopes are uncommon. In places, especially along slopes bordering streams, ledges of rock are exposed. Upon the slopes, beneath these

rocks, a deposit of colluvial fine sandy loam of about the same characteristics as that above is generally found.

All of the type is found under prairie conditions, with a few mesquite trees in depressions. A large part of this soil still remains in sod, and is pastured. The curly mesquite grass predominates, though much of the original broom sedge remains.

A large part of this type is cultivated, especially the eastern areas. Good results are obtained where the underlying rock is not too close to the surface, and as a whole the soil is regarded as more desirable than the shallow phases of the Vernon fine sandy loam, owing to a higher average content of organic matter, which renders it more drought resistant, and somewhat more soft and loamy, so that a surface mulch is easier to maintain.

Cotton is the principal crop, and yields, with fair rainfall, from one-half to three-quarters bale per acre. One bale per acre has been grown. Corn is grown, though in dry years it usually fails to mature profitable crops. In good years from 25 to 30 bushels per acre are realized where proper cultural methods are used. Grains, sorghum, and other crops yield about the same as on the Vernon fine sandy loam. Land values range from \$15 to \$30 an acre.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil of the Windthorst fine sandy loam:

Mechanical analyses of Windthorst fine sandy loam.

Number.	Description.	Fine	Coarse	Medium	Fine	Very fine	Silt.	Clay.
		gravel.	sand.	sand.	sand.	sand.	Per cent.	Per cent.
443692, 443694.....	Soil.....	0.0	0.4	4.9	50.7	18.8	12.8	12.2
443693, 443695.....	Subsoil.....	.2	.9	4.5	43.0	12.3	15.2	23.8

ROUGH STONY LAND.

The Rough stony land comprises those areas in which rock outcrops are so numerous and the surface so broken that cultivation is impossible. Such areas include precipitous bluffs along the larger valleys and narrow mesas and rocky patches dotting the eroded phase of the Vernon clay. Other areas of this character, too small to be shown on the map, are included in the various soil types, their position being indicated by the rock outcrop symbol.

The soil of the Rough stony land is generally a very shallow fine sandy loam, the sandstone from which it is derived being encountered at a few inches to 2 feet from the surface. It is usually yellowish and strongly mottled with shades of orange, red, drab, and brown.

Most of the soil supports a growth of curly mesquite and other grasses, which barely exist during the droughts but afford good grazing at other times.

SUMMARY.

Archer County, with an area of 886 square miles, or 567,040 acres, is situated in the north-central part of Texas.

The topography is that of a level to undulating and moderately broken plain.

The northwestern part of the county is drained through the Wichita River, the southeast corner through the tributaries of the Trinity River, and the remainder of the county through the Little Wichita River and its tributaries.

Good transportation facilities are provided by four railroads and a number of public highways.

The climate is characterized by irregularities in temperature, in annual precipitation, and in distribution of rainfall through the year. Hot winds of a severity to injure crops are also a peculiarity of the region. The rainfall in normal years is sufficient to mature crops without irrigation.

Ranching is the principal industry, but general farming is increasing. Cotton is the leading crop. Kafir, milo, and sorghum are the crops best adapted to the region, because of their ability to withstand drought. Oats, wheat, speltz, Johnson grass, millet, barley, and rye have been successfully grown. Corn is very uncertain. Peaches, plums, and grapes, as well as melons, do well on the sandy soils. With irrigation, trucking on the bottom lands is profitable. Alfalfa is grown in small patches on both the bottom lands and uplands.

The soils are divided into two general groups, the smaller consisting of the bottom-land or fluvial soils, and the larger of the upland or residual soils. Eighteen types are mapped, exclusive of the Rough stony land.

The Vernon soils are by far the most extensive in their development, and are well adapted to general farming. They occupy gently undulating to rolling areas in the upland. The color ranges from chocolate brown or reddish brown to brownish red.

The Greensburg soils are dark brown to black in color and are the most fertile of the upland types, but are of small extent. The surface is generally flat.

The Windthorst soils are usually sandy and shallow, being more subject to drought than soils of other series. The surface is undulating to rolling.

The Kirkland soils are comparable with the Vernon in productivity. They occupy broad flats and gently undulating to gently rolling stretches. They are medium to dark brown in color, ranging between the Greensburg and Vernon series.

In the Miller series the heavy types predominate. The soils occupy the flood plains, and are most extensively developed along the Little Wichita River and its larger tributaries. They occupy flat surfaces and could be easily irrigated. The soils are very productive.

The Bastrop soils occupy the higher terraces and are farmed extensively. Owing to their light, sandy nature, their productivity, and flat surface, they constitute very desirable farming land. Where irrigation is practiced on these soils, crop failures are practically unknown.

The great needs of the area are the development of a type of farming combining stock raising and farming, the practice of deeper and earlier plowing, the maintenance of a surface mulch, the use of green or stable manures, careful rotation of crops, and the more extensive growing of the legumes.

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